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00003] Generally, in their most common form, these devices utilize an optical lens such as a magnifying glass to enlarge the view of an object as perceived by the human eye. Due to the convex nature of the lens, however, only a small portion of the lens may be effectively utilized for focusing on an object without undesirable shifting of the

object from view, resulting in image stabilization problems that can be quite distracting to the user. Achieving focusing is also an issue which requires the user to physically move the glass in order to obtain a focused image. The optical lens also requires ample lighting for proper viewing. In addition, a typical magnifying glass only magnifies, and provides no additional features such as color contrast or other forms of image enhancement.

HR L [0006] [0004] Other forms of magnifying glasses have tried to address the illumination issue by use of a lamp installed on some frame portion of the magnifying glass. This however, suffers from the shortcomings of loss of brightness from the light source as the gain to the image size increases. Furthermore, the provided illumination oftentimes lacks uniformity and typically cannot be adjusted in intensity. In addition, the foregoing problems of achieving focusing and lack of additional features such as color contrast or other forms of image enhancement still remain at issue.

HR L [0007] [0005] A third form of visual aid is the use of electronic camera in conjunction with a separate video monitor. Disadvantages associated with this approach is the lack of portability of the whole system, complicated connections and setups, and excessive cost. In addition, human physiology may also be compromised in form of neck and back strain, and even nausea from visual disorientation as a user is required to constantly shift focus from the camera to the video monitor. In addition, the camera unit in this setting is fixed in orientation, thus requiring that the object be brought to the instrument, which may not always be possible or convenient.

HR L [0008] [0006] It is therefore an object of the present invention to provide an apparatus that is small in size, portable, and capable of providing illumination and a

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variety of image enhancement and magnification features to facilitate the viewing of an object by human eye.

Summary of the Invention

HR L JUL 5 1971 [0000] [00007] These and other objects are achieved by apparatus of the present invention. In a broad aspect, the present invention provides novel apparatus for facilitating viewing of an object by human eye. The apparatus includes a holder mechanism having a support portion with opposing first and second support surfaces, at least one light source disposed on the holder mechanism first surface to illuminate at least a portion of the object and at least one electronic camera unit disposed on the holder mechanism first surface, the camera being operative to record at least one image of the object.

HR L [0010] [00008] The apparatus further includes at least one image processor module in electrical communication with the camera unit to format the recorded image for display, at least one image display device having a display region, the display device disposed on the holder mechanism second surface and in electrical communication with the image processor module to display the formatted image on the display region, and at least one user-interfaced control mechanism disposed on the holder mechanism and in electrical communication with the image processor module for controlling the operations of the module to regulate display of the image by the display device.

HR L [0011] [00009] A more detailed understanding of these features, and of additional features, objects, and advantages of the present invention will be provided to those skilled in the art from a consideration of the following Detailed Description of the Invention, taken in conjunction with the accompanying Drawings, which will now first be described briefly.

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FIG. 2 provides a cross-sectional view further illustrating the additional understanding and features of

an exemplary embodiment of the present invention. As shown in **FIG. 2**, the viewing device 1 includes a support portion 200 having opposing surfaces 200a and 200b. At least one light source 500 is disposed on one of the holder mechanism's opposing surfaces, such as opposing surfaces 200b, to illuminate at least a portion of a desired object to be viewed.

HR/L [0018]  
[0016] The viewing device 1 also includes electronic camera unit 600 disposed on the same opposing surface as the light source 500, to capture at least one image of the object, desirably as illuminated by the light source 500. Once an image of the object is captured, it is transmitted to the image processor module 400 which formats and enhances the captured image for display on the display unit 100 of the display device 101 located on the surface opposite to that of the camera unit 600. The operations of the image processor module 400 are explained in more detail in conjunction with **Fig. 3** below.

HR/L [0019]  
[0017] The viewing device 1 further includes at least one of user-interface control mechanisms 300, 301 or 302 disposed on the apparatus, such as on the handle portion 201, and in electrical communication with the image processor module 400 for controlling the operations of module 400 to regulate display of the image by the display device 101 by a user. The user can regulate the display device 101 in various ways that include but are not limited to adjusting the magnification or enhancement of the displayed image on display region 100, changing preferences such as auto power-off time, saving and recalling stored images as well as adjusting the illumination intensity of the light source 500 and the focusing operations of the camera unit 600.

HR/L [0020]  
[0018] In an exemplary embodiment of the present invention, the viewing device 1 includes an internal power

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source 700, such as a rechargeable battery, that is housed in the handle portion 201 or support portion 200 to provide operational power to at least one of the camera unit 600, the image processor system 400, light sources 500 and image display device 101. External power sources such as adapters or transformers can also be connected to the viewing device 1 through power port 701 to provide power to the viewing device 1 as well as to recharge the rechargeable batteries.

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**Fig. 3** provides a circuit block diagram illustrating in more detail the operations of the image processor module 400. As shown, the image processor module 400 includes processor system 405 and memory medium 406. The processor 405 is in electrical communication with the camera unit 600, the light sources 500, the display device 100 and the control mechanisms 300, 301 and 302 (not shown). In addition to formatting the captured image for display, the processor system 405 also monitors and controls the operations of the above components and receives operational instructions from the user via user inputs on the control mechanisms 300, 301 and 302. These instructions include but are not limited to instructions to adjust the magnification level, illumination intensity, and the focusing resolution level of the displayed image on the display region 100. In addition, the instructions may also include instructions to adjust the focusing characteristic of the camera unit 600, zoom mode, image enhancement such as color mapping, edge detection, and inverse video display, as well as the illumination intensity of the light source 500.

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The processor 405 is in electrical communication with the image memory storage medium 406 for storage and retrieval of the pre-stored and/or user-inputted instructions as well as captured and formatted images.

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In an exemplary embodiment of the present

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invention as shown in **Fig. 3**, the processor system 405 includes sub-processors 401 and 402 having dedicated memory storage mediums 403 and 404.<sup>1</sup> In this configuration, one of the sub-processors, such as 401 is dedicated to initializing the camera unit 600 and managing the transferring of raw image data from the camera unit 600 into the memory storage medium 403. The other sub-processor, such as 402, is dedicated to receiving user instructions from the control mechanisms 300, 301 and 302 and transferring data from memory storage medium 404 into display device 100. This sub-processor also performs image modification and manipulations as data is transferred from memory storage medium 403 to memory storage medium 404. In this way, faster processing of the images and the user-inputted instructions is achieved. In addition, each of the sub-processors is provided with its own memory storage unit, such as memory storage mediums 403 and 404 to store instructions and images for that processor.

HRK [00247]  
[00221] In another exemplary embodiment of the present invention, the image processing module 400 is a programmable image processing module and can receive new preprogrammed instructions such as by inclusion or interfacing with an Electrically Erasable Programmable Read Only Memory (EEPROM) unit. In addition, an optical alpha-numeric character recognition module can also be included to recognize words and numbers in the image of a text. Also included is a voice synthesizer module to output sound patterns corresponding to the pronunciation of these recognized words and numbers.

HRK [00235]  
[00231] Other features and functions of the image processing module 400 may include, but not limited to: image or text processing and enhancement for flat or curved

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<sup>1</sup> I would appreciate if you could please provide me with some further detail as to the operations of the processors as shown in Figure 3.

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objects; image stabilization such as by auto focus and by auto track/cancellation of image jitter due to small hand movements, focus track, auto zoom, selectable or variable zoom, freeze frame and no movement of image opposite to hand motion; color shifting; brightness and contrast enhancement; infrared photography and edge detection and line drawing conversion. In addition, the processor 405 and storage medium 406 can be any commercially available product adapted to user interfacing features of the control mechanism and having features of image processing, data storage and other functions performed by the image processor as disclosed herein.

HR- (60246)  
100241 Returning to FIG. 1 and FIG. 2, the user-interface control mechanisms 300, 301 and 302 are now discussed in greater detail. As illustrated, control mechanisms 301, 302 represent a manual input button for selecting at least one operation of the image processor module 400, such as adjusting the illumination on the displayed image. In an exemplary embodiment, the user may use button 301 to browse through a menu and make a selection, then use button 302 to commit that selection to the image processor module 400, such as for execution or storage. Control mechanism 300 is a finger-operated selection device that allows browsing, selecting, and committing of the operations with an adjusting rolling switch. Other equally effective finger operated selection devices such as a sliding switch (not shown) may also be used in conjunction with the present invention. In an exemplary embodiment of the present invention, a graphic user interface (GUI) device may be used, alone or in combination with the above control mechanisms for browsing, selecting and committing of the operations of the image processor module 400. The GUI device may also be displayed in a portion of the display region 100. Other control

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~~100271~~ Additionally, support portion 200 and handle portion 201 can be formed of any available electrically compatible material having sufficient compressive and tensile strength to function in its intended environment as a support ground to the components of the present invention. Exemplary materials include grade metals such as stainless-steel and durable ceramics as well as grade plastics and composites. In the exemplary embodiment of the viewing device 1 shown in the figures, support portion 200 and handle portion 201 are formed of grade plastics. However, it should be emphasized that this is not a

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Other embodiments, features, and advantages of the present invention will be apparent to those skilled in the art from a consideration of the foregoing specification as well as through practice of the invention and alternative embodiments and methods disclosed herein. Therefore, it should be emphasized that the specification and examples are exemplary only, and that the true scope and spirit of the invention is limited only by the following claims.